

**Process Hazard Analysis (PHA) -
[Date]**

Submitted to:

Prepared by:

Project Manager

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APPENDIX A: HAZARD EVALUATION TEAM SIGN-IN SHEETS

1.0 PURPOSE AND SCOPE OF PROCESS HAZARD ANALYSIS (PHA)

The purpose of this project is to assist _____ in updating their process hazard analysis (PHA) for the entire facility. Future updates will combine these two PHAs into one for the entire facility. This PHA is required to be revalidated every five years as specified in the Risk Management Program (RMP) rules found in 40 CFR Part 68 and the Process Safety Management (PSM) rules found in 29 CFR 1910.

The purpose of a PHA is to identify, evaluate, and control hazards in a process. The PHA must be appropriate to the complexity of the process and must be conducted in a priority order based on the hazard and potential consequences. The methodology used must be appropriate to determine and evaluate the hazards and must address the following:

- Previous process hazard incidences with potential for catastrophic consequences;
- Engineering and administrative controls, and consequences of their failure;
- Stationary source siting;
- Human factors; and,
- Qualitative evaluation of a range of safety and health effects that may result from process failures.

Use of one (or more) of the following methodologies is acceptable:

- What-If;
- Checklist;
- What-If/ Checklist;
- Hazard and Operability Study (HAZOP);
- Failure Mode and Effects Analysis (FMEA);
- Fault-Tree analysis; or,
- An appropriate equivalent methodology.

Note that PHAs must be revalidated every five years and any reports, updates, recertification, and documented resolutions must be retained for the life of the process.

2. OFF-SITE CONSEQUENCE ANALYSIS

[Date]

OFF-SITE CONSEQUENCE ANALYSIS

Worse-case:

The worse case scenario is a vapor cloud explosion of the largest storage tank at maximum capacity of propane. The largest tank onsite is _____ gallons, and holds _____ pounds of _____ (based on Annex D of EPA's *Risk Management Program and OSHA Process Safety Management: List of Regulated Substances*). Using R^{MP}*Comp, the distance to 1 psi overpressure endpoint is _____ miles from the site. The quantity released is _____ pounds, the entire contents of the tank. The wind speed assumed is 1.5 m/s, with a stability class of F and a temperature of 77°C. The topography of the site is urban. No passive mitigation was considered.

Using the LandView 5 program with 2010 Census data, the estimated population in a _____ mile radius of the site is _____. Public receptors within the radius include _____.

Alternative case #1:

The alternative scenario considered is a vapor cloud explosion of propane caused by a release from a ruptured pipe. The amount of time assumed for the release is _____ minutes. The flow rate is _____ lb/min. The total release was estimated to be _____ pounds. Using R^P*Comp, the distance to 1 psi overpressure endpoint is 0.1 miles from the site.

Using the LandView 5 program with 2010 Census data, the estimated population in a _____ mile radius of the site is _____. Public receptors within the _____ mile radius include _____.

Alternative case #2:

The alternative scenario considered is a vapor cloud explosion of _____ caused by a release from a ruptured pipe. The amount of time assumed for the release is _____ minutes. The flow rate is _____ lb/min. The total release was estimated to be _____ pounds. Using R^P*Comp, the distance to 1 psi overpressure endpoint is _____ miles from the site.

Using the LandView 5 program with 2010 Census data, the estimated population in a _____ mile radius of the site is 0. Public receptors within the _____ mile radius include _____.

[Date]

3.0 PHA METHODOLOGY

Plaze utilized the Hazard and Operability Study (H[^]ZOP) for this PHA. The H[^]ZOP methodology utilizes a brainstorming approach where people knowledgeable and experienced in the facility's operations evaluate the process for potential release possibilities.

For consistency and to maintain the integrity of ongoing compliance efforts at the Site, this PHA utilized the selection of "guidewords" and "nodes". EPA has listed twenty-eight (28) recommendations from previous studies of flammable release incidents. For a complete listing of these "guidewords", refer to EPA's website. "Nodes" are identified as separate portions of the batching process. It should be noted that the batching process-specific PHA is already addressed under a separate stand alone PHA and is consequently omitted from this entire system P[^]A. Future updates will combine these two PHAs into one for the entire facility. For the purposes of this PHA, following are the "nodes" addressed:

- Entire System — Buildings 1 & 2;
- Storage Tanks;
- Truck Unloading;
- Propane Piping; and,
- Gashouse.

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4.0 HAZARD EVALUATION TEAM

The HAZOP evaluation team consisted of the following personnel:

- - Environmental Director - Plaze, Inc.;
- - Safety Director - Plaze, Inc/
- - Operations Manager; and,
- - Principal -

The team went through the HAZOP on May 31,2013 at an offsite restaurant near te facility and, again on Jnne 28, 2013 and July 31,2013 at the same location.

5.0 HAZOP RISK ANALYSIS MATRIX

FREQUENCY CONSEQUENCE	A (Frequent; >IX yr)	B (Periodical; 1+ times/ decade)	C (Occasional - likely to occur during life of plant)	D (Possible; not expected, but could occur)	E (Very unlikely)
I Catastrophic (death; \$1MM property damage)	1	1	1	2	4
II Severe (multiple injuries; \$100K property damage)	1	2	3	3	4
III Moderate (single injury; \$10K property damage)	2	3	4	4	4
IV Slight (operational only; no injuries or damage)	4	4	4	4	4

RISK CODES:

- 1 - Critical; must be improved**
- 2 - Undesirable; must be improved**
- 3 - Acceptable; with controls**
- 4 - Acceptable as is**

6.0 HAZOP STUDY

Following is the complete HHAZOP Study, presented by nodes as follows:

- Entire System
- Storage Tanks;
- Truck Unloading;
- Propane Piping; and,
- Gashouse.

Process Hazard Analysis (PHA)-

[Date]

7.0 HAZOP SUMMARY AND RECOMMENDATIONS

Following is the HAZOP Summary, which includes a list of corrective actions required from the PHA.

HAZOP SUMMARY AND RECOMMENDATIONS

[illegible]

**APPENDIX A: HAZARD
EVALUATION TEAM SIGN-IN
SHEETS**

PROCESS HAZARDS ANALYSIS (PHA) TEAM MEETING

DATE:

TEAM MEMBER NAME (SIGNATURE)	TEAM MEMBER NAME (PRINTED) <small>ROLE/TITLE</small>
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PROCESS HAZARDS ANALYSIS (PHA) TEAM MEETING

DATE:

[illegible]

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
ENTIRE SYSTEM - BLDGS. 1 & 2												
1.1	ENTIRE SYSTEM	Establish training programs to ensure that the propane system is operated and maintained by Knowledgeable personnel.		Personnel wouldn't be trained	D	I	2	New tracking; initially plus every three years				
1.2	ENTIRE SYSTEM	Develop and require propane maintenance personnel to follow written, standard procedures for maintaining the system. In-house checklists are used to guide maintenance personnel while they execute these procedures.		Equipment failure	C	II	3	Daily checklist; tanks checked three times				
1.3	ENTIRE SYSTEM	Provide barriers to protect propane equipment, i.e. lines, valves, and piping, from impact.		Vehicle could hit tank or piping	O	I	2	Chain link fence in-place	Evaluate need for ballards around key access to tanks & piping			
1.4	ENTIRE SYSTEM	Develop and maintain a written preventive maintenance program and schedule based on the manufacturers recommendations for all of the propane equipment. The preventative maintenance program should include, but not be limited to: a) pumps b) contra! valves c) LEL meter 1) Yellow level at 20% secondary exhausts on 2) Red level - everything is shut off d) emergency response equipment, Including: 1) air monitoring equipment 2) level B suits 3) air-purifying respirators.		Equipment failure or release	D	I	2	PSM in-place and being revised and updated				
1.5	ENTIRE SYSTEM	Maintain a leak-free propane system. Investigate all reports of a release and repair all leaks immediately.		Unnoticed release	C	I	1	Visual verification				
1.6	ENTIRE SYSTEM	Keep an accurate record of the amount of propane that Is purchased and the amount that Is used.		Overfill tank	D	II	3	Daily (three times) and monthly volumes checked. Admin procedure at 85% capacity				

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
1.7	ENTIRE SYSTEM	Ensure that good housekeeping procedures are followed.	Poor housekeeping	Debris in system	D	IV	4	Daily walk-through				
1.8	ENTIRE SYSTEM	Ensures that propane system lines and valves are adequately identified (e.g., by color coding or labeling) by using an in-house system.		Blending of wrong gases	D	m	4	Bulkhead, tanks and piping labeled				
1.9	ENTIRE SYSTEM	Properly post propane placards and warning signs in areas where propane is being used or being stored.		Ignition source too close	D	I	2	Warning signs and placards posted on tanks and fence				
1.10	ENTIRE SYSTEM	Periodically inspect all propane piping for rust and corrosion. Replace all deteriorated piping as needed. Protect all un-insulated piping from rust and/or corrosion by cleaning, priming, and painting with an appropriate coating.		Piping failure	E	m	4	Part of monthly audit. Cleaned and painted every other year.				
1.11	ENTIRE SYSTEM	Carry out regular inspections of emergency equipment and keep respirators, including air-purifying and other equipment in good shape; for air-purifying respirators, replace cartridges as need and check expiration dates.		Injury	C	i	1	Inspection procedure for emergency equipment				
1.11.1	ENTIRE SYSTEM	Ensure that personnel are trained in proper use of emergency equipment		Injury	E	i	4	Training				
1.12	ENTIRE SYSTEM	Identify the main shutoff valve and other emergency isolation valves with a large placard so they can be easily identified by emergency responders, in case of an emergency. These valves should be clearly indicated on the piping and instrumentation diagram (P&IDs) and/or process flow diagrams.		Unable to stop/control release	E	i	4	Shutoffs and valves ID'd and redundant (air, manual, and thermal)				
1.13	ENTIRE SYSTEM	Establish emergency shutdown procedures and instructions on what to do during and after a power failure.		Propane solenoids, motors and pumps will immediately shut down in event of power outage	B	m	3	Develop SOP for re-start	Evaluate power shutoff requiring manual re-start			
1.14	ENTIRE SYSTEM	Establish written emergency procedures and instructions on what to do in the event of a propane release.		Injury	D	i	2	ERP In-place				

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
1.15	ENTIRE SYSTEM	Regularly conduct emergency response drills. Members of the hazmat team should regularly participate to sharpen their emergency response skills.		Injury	D	I	2	Annual Drills				
1.16	ENTIRE SYSTEM	Keep piping and instrumentation diagrams (P&IDs), process flow diagrams, ladder diagrams, or single lines up-to-date and incorporate them into training programs for operators.		Unable to identify key control points	D	I	2	Drawings are current				
2.1	ENTIRE SYSTEM	EARTHQUAKE		Release	D	I	2	Shear w/excess flow valves built-in				
2.2	ENTIRE SYSTEM	FLOODS		Release	D	I	2	Shear w/excess flow valves built-in				
2.3	ENTIRE SYSTEM	HIGH WINDS/ TORNADOS		Release	D	I	2	Shear w/excess flow valves built-in				
2.4	ENTIRE SYSTEM	LOSS OF ELECTRICITY		Pumps, motors, and solenoids shutdown	B	m	3	N/A				
2.5	ENTIRE SYSTEM	LOSS OF UTILITY WATER		Loss of fire protection	E	i	4	N/A				
2.6	ENTIRE SYSTEM	PROPANE CLOUD		Injury and damage	E	i	4	Redundant controls				
2.7	ENTIRE SYSTEM	FIRE		Injury and damage	E	i	4	Redundant controls				
2.8	ENTIRE SYSTEM	LOSS OF PHONE SERVICE		Unable to contact responders	D	n	3	None				
3.1	ENTIRE SYSTEM	Instruments out of calibration		Overfill or release	D	i	2	Daily readings; gas alarms; monthly inspections				
3.2	ENTIRE SYSTEM	Worker standing on unsupported piping or small, weak propane line	Human error	Broken piping	D	m	4	Line supports in place and crossovers				
3.3	ENTIRE SYSTEM	Pipe fittings and equipment connections not tight enough when installed	Human error; improperly sized connections	Release	E	IV	4	Leak checks performed on installation				
3.4	ENTIRE SYSTEM	Operator turned wrong valve during startup or other operation	Human error	Release or contamination	D	IV	4	Training and signage				
3.5	ENTIRE SYSTEM	Falling ladder or other heavy equipment strikes and breaks propane piping	Human error	Release	E	m	4	Line supports in-place for piping				

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
3.6	ENTIRE SYSTEM	Overfill of propane storage equipment	Human error	Release	D	I	2	Admin SOPs, gauges.	Add gas alarms (MSA)			
3.7	ENTIRE SYSTEM	Propane trapped between closed block valves		Line Failure	E	IV	4	Hydrostatic relief valves				
3.8	ENTIRE SYSTEM	Employee injury from not wearing approved safety equipment	Human error	Injury	D	m	4	Training and appropriate PPE				
3.9	ENTIRE SYSTEM	Delivery vehicle driver drives off with the loading hoses still connected	Human error	Damage or release	D	m	4	Shear valves; breakaways in bulkhead; training requirements				
3.10	ENTIRE SYSTEM	Piping downstream downsized making excess flow valves ineffective	Human error; improperly sized Di/Ding	Release	E	i	4	Standard size piping used throughout system				
3.11	ENTIRE SYSTEM	Tools, maintenance spares or other storage items prevents proper access to propane containing equipment	Poor housekeeping	Unable to access equip	E	IV	4	Good housekeeping practices				
3.12	ENTIRE SYSTEM	Control or shutdown valves in hard or impossible places to access	Poor equipment design	Slow response to shut off equip	D	IV	4	Primary emergency shutdowns are easily accessible				
3.13	ENTIRE SYSTEM	Maintenance man "opens" a propane line under pressure	Human error	Release	D	m	4	Training and redundant shut off valves				
4.1	ENTIRE SYSTEM	ACCESSIBILITY / AVAILABILITY OF CONTROLS, EQUIPMENT			N/A			Inspection procedure for emergency equipment, Training and appropriate PPE, Primary emergency shutdowns are easily accessible				
4.2	ENTIRE SYSTEM	WORKLOAD AND STRESS		Injury	D	m	4	Scheduled breaks, extra breaks during excessive heat/cold				
4.3	ENTIRE SYSTEM	COMPONENT LABELING			N/A			Warning signs and placards posted on tanks and fence, Shutoffs and valves ID'd and redundant (air, manual, and thermal)				
4.4	ENTIRE SYSTEM	PROCEDURES	Human error or not trained	Injury or release	D	i	2	SOPs and training				
4.5	ENTIRE SYSTEM	SABOTAGE THREAT		Injury or release	E	i	4	Chain link fence around tanks - valves and gashouse locked during off hours - dusk to dawn tights				
4.6	ENTIRE SYSTEM	SAFETY SHOWER, EYE WASH	Networking properly	Greater risk of injury	D	IV	4	Safety shower & eye wash stations in place				

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
4.7	ENTIRE SYSTEM	OSHA MANDATED SAFETY		Injury	D	n	3	PSM in-place and being updated - annual training				
4.8	ENTIRE SYSTEM	SECURITY					N/A	Chain link fence around tanks - valves and gashouse locked during off hours - dusk to dawn lights				
5.1	ENTIRE SYSTEM	FACILITY LAYOUT		Injury and damage	E	I	4	Gashouse piping and tanks designed to meet NFPA standards				
5.2	ENTIRE SYSTEM	PIPING					N/A	Bulkhead, tanks and piping labeled, Part of monthly audit Cleaned and painted every other year, All drawings being currently updated, Line supports in-place for piping, Gashouse piping and tanks designed to meet NFPA standards				
5.3	ENTIRE SYSTEM	SYSTEM LAYOUT					N/A	Bulkhead, tanks and piping labeled, Part of monthly audit Cleaned and painted every other year, AD drawings being currently updated, Line supports in-place for piping, Gashouse piping and tanks designed to meet NFPA standards				
5.4	ENTIRE SYSTEM	PIPING LAYOUT					N/A	Bulkhead, tanks and piping labeled, Part of monthly audit Cleaned and painted every other year, AO drawings being currently updated, Line supports in-place for piping, Gashouse piping and tanks designed to meet NFPA standards				
5.5	ENTIRE SYSTEM	EQUIPMENT ARRANGEMENT LAYOUT					N/A	Bulkhead, tanks and piping labeled, Part of monthly audit Cleaned and painted every other year, AO drawings being currently updated, Line supports in-place for piping, Gashouse piping and tanks designed to meet NFPA standards				
5.6	ENTIRE SYSTEM	STORAGE					N/A	Inspection procedure for emergency equipment Good housekeeping practices, Gashouse piping and tanks designed to meet NFPA standards				
Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R

5.7	ENTIRE SYSTEM	LOCATION OF PEOPLE		Injury	E	I	4	RMP/PSM in-place and being updated			
5.8	ENTIRE SYSTEM	OTHER BUILDING LOCATIONS			N/A			Gashouse piping and tanks designed to meet NFPA standards			
5.9	ENTIRE SYSTEM	EMERGENCY STATIONS AND ASSEMBLY AREAS		Injury	D	I	2	Emergency Response Plan (ERP) and training.			
5.10	ENTIRE SYSTEM	EMERGENCY EQUIPMENT LOCATION			N/A			Inspection procedure for emergency equipment, Annual Drills, appropriate PPE, Emergency Response Plan (ERP) and training			
5.11	ENTIRE SYSTEM	FIREFIGHTING CAPABILITIES		Fire	D	I	2	Portable extinguisher Inspection procedure for emergency equipment, Annual Drills, appropriate PPE, Emergency Response Plan (ERP) and training	Fire suppression in Gashouses 1 & 2 will be accomplished over next 3 years as Gashouses are replaced		
5.12	ENTIRE SYSTEM	SIGNAGE			N/A			Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence, Shutoffs and valves iD'd and redundant (air, manual, and thenri3l)			
5.13	ENTIRE SYSTEM	LIGHTING		Theft or sabotage or injury	E	IV	4	Dust-to-dawn lighting in place			

STORAGE TANKS

6.1	Storage Tanks	NO FLOW/ LESS FLOW	Excess flow valve shut	Operational only	E	IV	4	Daily inspections or operation slowdown	Install MSAs in tank farm			
6.1.1	Storage Tanks	NO FLOW/ LESS FLOW	Pump failure	Injury and/ or release	C	III	4	Daily inspections or operation slowdown	MSAs in tank farm			
6.1.2	Storage Tanks	NO FLOW/ LESS FLOW	Downstream valve dosed	Operational only	E	IV	4	None				
6.1.3	Storage Tanks	NO FLOW/ LESS FLOW	Backcheck valve stuck closed	Operational only	E	IV	4	Maintenance Inspections				

Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R

6.2	Storage Tanks	REVERSE FLOW	Backcheck valve stuck open	Release	E	IV	4	Maintenance inspections				
6.3	Storage Tanks	MORE FLOW	Excess flow valve failed	Release	D	I	2	Daily Inspections				
6.3.1	Storage Tanks	MORE FLOW	Pipe break	Release	E	I	4	Daily Inspections				
6.3.2	Storage Tanks	MORE FLOW	Pump pressure set too high	Release	B	IV	4	SOP-Daily start-up				
6.4	Storage Tanks	TANK RUPTURE	Vehicle impact	Fire/ explosion	D	I	2	Chain link fence 8i ballards inplace				
6.4.1	Storage Tanks	TANK RUPTURE	Fire	Explosion	E	I	4	Hydrostats would bleed off portion of gas; internal excess flow valve @ bottom of tank would dose				
6.4.2	Storage Tanks	TANK RUPTURE	Sabotage	Release	E	IV	4	Chain link fence around tanks - valves and gashouse locked during off hours - dusk to dawn lights				
6.5	Storage Tanks	MORE TEMPURATURE	Overfilling tank	Release	D	I	2	Fill gauges; SOPs; Pressure Relief Valves				
6.6	Storage Tanks	CONTAMINATION	Debris in line	Valve/ Fitting Failure	D	I	2	Filter screens and Y-strainer in bulkhead				
6.6.1	Storage Tanks	CONTAMINATION	Wrong material in tank	Operational	C	IV	4	Labels; placards; training 8i SOPs				
6.7	Storage Tanks	RELIEF VALVE FAILURE	Debris in line	Valve/ Fitting Failure	D	I	2	Filter screens and Y-strainer in bulkhead				
6.7.1	Storage Tanks	RELIEF VALVE FAILURE	Valve stuck open	Release	D	I	2	Daily Inspections				
6.7.2	Storage Tanks	RELIEF VALVE FAILURE	Valve stuck dosed	Release	D	I	2	Daily Inspections				
6.8	Storage Tanks	INSTRUMENTATION	Fill gauges working improperly	Release	D	I	2	Daily Inspections; Monthly Complete System Inspections				
6.8.1	Storage Tanks	INSTRUMENTATION	Temperature gauges working improperly	Release	D	I	2	Daily Inspections; Monthly Complete System Inspections				
6.8.2	Storage Tanks	INSTRUMENTATION	Pressure gauges working improperly	Release	D	I	2	Daily Inspections; Monthly Complete System Inspections				
6.9	Storage Tanks	CORROSION/ EROSION	Tank and/ or piping not maintained	Release	E	IV	4	Daily Inspections; Monthly Complete System Inspections; SOPs				
6.10	Storage Tanks	IGNITION	Sparks from vehicle	Fire/ explosion	E	I	4	Chain link fence 8i road barricaded when unloading				
Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R

6.10.1	Storage Tanks	IGNITION	Sparks from static discharge	Fire/ explosion	D	1	2	Training; Grounding; SOPs			
6.10.2	Storage Tanks	IGNITION	Electrical sparks	Fire/ explosion	D	1	2	Training; Grounding; SOPs; and PSM			
6.10.3	Storage Tanks	IGNITION	Sparks from use of improper tools	Fire/ explosion	D	1	2	Training; Grounding; SOPs; and PSM			
6.11	Storage Tanks	UNPLANNED SHUTDOWN	Weather-related or power outage	Release or shutdown of system	D	1	2	Tank valves are shut off at end of each shift; Develop SOP for re-start, Shear w/excess flow valves built-in	Evaluate power shutoff requiring manual re-start.		
6.12	Storage Tanks	HUMAN FACTORS	Sparks from static electricity	Fire/ explosion	D	1	2	Training; Grounding; SOPs			
6.13	Storage Tanks	SIGNAGE	Incorrect labeling of tanks		D	1	2	Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence			

TRUCK UNLOADING

7.1	Truck Unloading	NO FLOW	Valves dosed on bulk head	Operational	E	IV	4	Monitoring flow gauges			
7.1.1	Truck Unloading	NO FLOW	Release from tanker or hoses	Release	C	m	4	Emergency Stop Button and Excess flow valves			
7.2	Truck Unloading	REVERSE FLOW	Valves closed on bulk head	Operational	E	IV	4	Monitoring flow gauges			
7.2.1	Truck Unloading	REVERSE FLOW	Release from tanker or hoses	Release	C	m	4	Emergency Stop Button and Excess flow valves			
7.3	Truck Unloading	MORE PRESSURE	Valves in improper position	Release	c	in	4	Daily Inspections, SOPs			
7.3.1	Truck Unloading	MORE PRESSURE	Hose dogged	Release	c	HI	4	Emergency Stop Button			
7.3.2	Truck Unloading	MORE PRESSURE	Bulk head fittings clogged	Operational		N/A		N/A			
7.3.3	Truck Unloading	MORE PRESSURE	Backcheck on tanker could be clogged/ dosed	Bulk tanks could over- pressurizt	C	HI	4	Emergency relief vents would engage			
7.4	Truck Unloading	LESS PRESSURE	Valves closed on bulk head	Operational	E	IV	4	Monitoring flow gauges			

Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R

7.4.1	Truck Unloading	LESS PRESSURE	Release from tanker or hoses	Release	C	m	4	Emergency Stop Button and Excess flow valves			
7.5	Truck Unloading	MORE TEMPURATURE	Excessive ambient temperature for extended period	Fire/ explosion	D	i	2	Redundant controls, Portable extinguisher and fire suppression, Inspection procedure for emergency equipment, Annual Drills, appropriate PPE, Emergency Response Plan (ERP) and training			
7.5.1	Truck Unloading	MORE TEMPURATURE	Fire	Fire/ explosion	D	i	2	\Redundant controls, Portable extinguisher and fire suppression, Inspection procedure for emergency equipment, Annual Drills, appropriate PPE, Emergency Response Plan (ERP) and training			
7.6	Truck Unloading	LESS TEMPURATURE	Low ambient temperature for extended period	Operational	N/A			Daily checklist; tanks checked three times, PSM in-place and being revised and updated			
7.6.1	Truck Unloading	LESS TEMPURATURE	Unprimed pump	Operational	N/A			Daily checklist; tanks checked three times, PSM in-place and being revised and updated			
7.8	Truck Unloading	UNLOADING OPERATION	Premature disconnect from truck	Release	D	i	2	Emergency Stop Button and Excess flow valves			
7.8.1	Truck Unloading	UNLOADING OPERATION	Hose leak	Release	C	i	1	Emergency Stop Button and Excess flow valves			
7.8.2	Truck Unloading	UNLOADING OPERATION	Bad fit between couplings	Release	C	m	4	Emergency Stop Button			
7.8.3	Truck Unloading	UNLOADING OPERATION	Improper hook-up	Release	D	m	4	Emergency Stop Button			
7.8.4	Truck Unloading	UNLOADING OPERATION	Improper tools	Fire/ explosion	D	i	2	Training; Grounding; SOPs; and PSM			
7.9	Truck Unloading	CONTAMINATION	Debris in line	Valve/ Fitting Failure	D	i	2	Filter screens and Y-strainer in bulkhead			
7.9.1	Truck Unloading	CONTAMINATION	Wrong material in tank	Operational	N/A			Labels; placards; training & SOPs			
7.10	Truck Unloading	INSTRUMENTATION	Bad level gauge	Release	C	m	4	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections			
7.10.1	Truck Unloading	INSTRUMENTATION	Bad temp and/ or pressure gauges	Release	C	m	4	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections			

Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R

7.11	Truck Unloading	CORROSION/ EROSION	Tank and/ or piping not maintained	Release	E	m	4	Part of monthly audit Cleaned and painted every other year, Daily Inspections; Monthly Complete System Inspections; SOPs			
7.12	Truck Unloading	SERVICE FAILURE	Overflow of tank	Release	D	U	3	Admin SOPs, gauges; gas alarms in place			
7.13	Truck Unloading	IGNITION	Sparks from vehicle	Fire/ explosion	E	I	4	Chain link fence & road barricaded when unloading			
7.13.1	Truck Unloading	IGNITION	Sparks from static discharge	Fire/ explosion	D	I	2	Training; Grounding; SOPs			
7.13.2	Truck Unloading	IGNITION	Electrical sparks	Fire/ explosion	D	I	2	Training; Grounding; SOPs; and PSM			
7.14	Truck Unloading	STARTUP	Premature disconnect from truck	Release	D	I	2	Shear valves; breakaways in bulkhead; training requirements			
7.14.1	Truck Unloading	STARTUP	Hose leak	Release	C	in	4	Emergency Stop Button and Excess flow valves			
7.14.2	Truck Unloading	STARTUP	Bad fit between couplings	Release	C	m	4	Emergency Stop Button			
7.14.3	Truck Unloading	STARTUP	Improper hook-up	Release	C	m	4	Emergency Stop Button			
7.14.4	Truck Unloading	STARTUP	Improper tools	Fire/ explosion	D	i	2	Training; Grounding; SOPs; and PSM			
7.15	Truck Unloading	SHUTDOWN	Premature disconnect from truck	Release	D	i	2	Shear valves; breakaways in bulkhead; training requirements			
7.16	Truck Unloading	SHUTDOWN	Hose leak	Release	C	m	4	Emergency Stop Button and Excess flow valves			
7.16.1	Truck Unloading	SHUTDOWN	Bad fit between couplings	Release	C	m	4	Emergency Stop Button			
7.16.2	Truck Unloading	SHUTDOWN	Improper hook-up	Release	C	m	4	Emergency Stop Button			
7.17	Truck Unloading	HUMAN FACTORS	Sparks from static discharge	Fire/ explosion	D	i	2	Training; Grounding; SOPs			
7.17.1	Truck Unloading	HUMAN FACTORS	Electrical sparks	Fire/ explosion	D	i	2	Training; Grounding; SOPs; and PSM			
7.17.2	Truck Unloading	HUMAN FACTORS	Driver error	Premature disconnect from truck	D	i	2	Shear valves; breakaways In bulkhead; training requirements			
7.17.4	Truck Unloading	HUMAN FACTORS	Improper tools	Fire/ explosion	D	i	2	Training; Grounding; SOPs; and PSM			

Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R

7.17.5	Truck Unloading	HUMAN FACTORS	Improper training	Injury	D	I	2	New tracking; initially plus every three years, Training, and PSM				
7.17.6	Truck Unloading	HUMAN FACTORS	Could hookup at wrong bulk head	Fill wrong tank/ overflow	C	in	4	Labeled bulkheads; manual valve on tank; SOPs				
7.18	Truck Unloading	EXTERNAL EVENTS	Weather related	Fire/ explosion	D	i	2	ERP in-place, Annual Drills, Shear w/excess flow valves built-in				
7.18.1	Truck Unloading	EXTERNAL EVENTS	Vehicular related	Fire/ explosion	E	i	4	Chain link fence Si ballards inplace				
7.19	Truck Unloading	SIGNAGE	Improper labeling of valves		E	i	4	Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence				
7.19.1	Truck Unloading	SIGNAGE	Smoking too close	Fire/ explosion	E	i	4	New tracking; initially plus every three years, Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence				
7.19.2	Truck Unloading	SIGNAGE	Improper labeling of bulkheads		E	i	4	Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence				
PROPANE PIPING												
8.1	Propane Piping	NO FLOW/ LESS FLOW	Excess flow valve shut	Operational	N/A			N/A				
8.1.1	Propane Piping	NO FLOW/ LESS FLOW	Pump failure	Injury and/ or release	C	IV	4	Daily inspections or operation slowdown; MSAs in tank farm				
8.1.2	Propane Piping	NO FLOW/ LESS FLOW	Downstream valve closed (shut off)	Operational	C	IV	4	Hydrostats would bleed off portion of gas; internal excess flow valve @ bottom of tank would dose				
8.1.3	Propane Piping	NO FLOW/ LESS FLOW	Backcheck valve stuck closed	Operational	N/A			Hydrostats would bleed off portion of gas; internal excess flow valve @ bottom of tank would dose				
8.2	Propane Piping	REVERSE FLOW	Backcheck valve stuck open	Release	C	IV	4	Manual shutoff valve at bottom of tank				
8.2.1	Propane Piping	REVERSE FLOW	Loading lines switched		D	m	4	Labeled bulkheads; manual valve on tank; SOPs				

Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
8.3	Propane Piping	MORE FLOW	Excess flow valve failed	Release	C	II	3	Daily Inspections				
8.3.1	Propane Piping	MORE FLOW	Pipe break	Release	C	II	3	Daily Inspections				
8.3.2	Propane Piping	MORE FLOW	Pump pressure set too high	Release	D	I	2	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections				
8.4	Propane Piping	TANK RUPTURE	Vehicle impact	Fire/ explosion	E	I	4	Chain link fence 8i ballards inplace				
8.5	Propane Piping	TANK RUPTURE	Fire	Fire/ explosion	c	IV	4	Hydrostats would bleed off portion of gas; internal excess flow valve @ bottom of tank would dose				
8.5.1	Propane Piping	TANK RUPTURE	Sabotage	Fire/ explosion	E	IV	4	Chain link fence around tanks - valves and gashouse locked during off hours - dusk to dawn lights				
8.6	Propane Piping	MORE TEMPURATURE	Overfilling tank	Release	D	n	3	Admin SOPs, gauges; gas alarms in place				
8.7	Propane Piping	CONTAMINATION	Debris in line	Valve/ Fitting Failure	D	i	2	Filter screens and Y-strainer in bulkhead				
8.7.1	Propane Piping	CONTAMINATION •	Wrong material in tank	Operational	N/A			Labeled bulkheads; manual valve on tank; SOPs				
8.7.2	Propane Piping	RELIEF VALVE FAILURE	Debris in line	Valve/ Fitting Failure	D	i	2	Fitter screens and Y-strainer in bulkhead				
8.7.3	Propane Piping	RELIEF VALVE FAILURE	Valve stuck open	Release	c	n	3	Daily Inspections				
8.7.4	Propane Piping	RELIEF VALVE FAILURE	Valve stuck shut	Release	C	II	3	Daily Inspections				
8.8	Propane Piping	INSTRUMENTATION	Fill gauges	Release	D	i	2	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections				
8.8.1	Propane Piping	INSTRUMENTATION	Temperature gauges	Release	D	i	2	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections				
8.8.2	Propane Piping	INSTRUMENTATION	Pressure gauges	Release	C	II	3	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections				
8.9	Propane Piping	CORROSION/ EROSION	Tank and/ or piping not maintained	Release	E	m	4	Part of monthly audit Cleaned and painted every other year, Daily Inspections; Monthly Complete System Inspections; SOPs				
8.10	Propane Piping	IGNITION	Sparks from vehicle	Fire/ explosion	E	i	4	Chain link fence 8i road barricaded when unloading				
8.10.1	Propane Piping	IGNITION	Sparks from static discharge	Fire/ explosion	D	i	2	Training; Grounding; SOPs				

Item	Equip./ Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
8.10.2	Propane Piping	IGNITION	Electrical sparks	Fire/ explosion	D	I	2	Training; Grounding; SOPs; and PSM				
8.11	Propane Piping	UNPLANNED SHUTDOWN	Weather-related or power outage	Release or shutdown of system	N/A			Tank valves are shut off at end of each shift; Develop SOP for re-start. Shear w/excess flow valves built-in				
8.12	Propane Piping	HUMAN FACTORS	Sparks from static electricity	Fire/ explosion	D	I	2	Training; Grounding; SOPs				
8.13	Propane Piping	SIGNAGE	Incorrect labeling of tanks		E	I	4	Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence				
GASHOUSE												
9.1	Gashouse	NO FLOW	Malfunction in electric solenoid valves	Pump could fail if volume is too low	c	IV	4	Slowdown in operations				
9.1.1	Gashouse	NO FLOW	Malfunction in service valve inside gashouse	Pump could fail if volume is too low	c	IV	4	Slowdown in operations				
9.1.2	Gashouse	NO FLOW/ LESS FLOW	Valve closed from gashouse back to tank	Pressure buildup could blow hydrostat	c	III	4	Manual shut-off valve at tank				
9.2	Gashouse	REVERSE FLOW	Wrong return line hooked up	Operational	N/A			Labeled bulkheads; manual Valve on tank; SOPs				
9.2.1	Gashouse	REVERSE FLOW	Pump failure		c	IV	4	Daily inspections or operation slowdown; MSAs in tank farm				
9.2.2	Gashouse	REVERSE FLOW	Outside release	Release	c	III	4	ERP in-place, Emergency Stop Button and Excess flow valves				
9.3	Gashouse	MORE FLOW	Pump malfunction	Release	c	IV	4	Daily inspections or operation slowdown; MSAs in tank farm				
9.4	Gashouse	LOSS OF CONTAINMENT	Hose failure	Release	C	III	4	Set off MSA gas-detection alarm; solenoid valves would shut off stopping flow				
9.4.2	Gashouse	LOSS OF CONTAINMENT	Valve/ Seal failure	Release	c	III	4	Set off MSA gas-detection alarm; solenoid valves would shut off stopping flow				
9.4.3	Gashouse	LOSS OF CONTAINMENT	Improper gashead alignment	Release	c	III	4	Set off MSA gas-detection alarm; solenoid valves would shut off stopping flow				

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
9.4.4	Gashouse	LOSS OF CONTAINMENT	Booster failure	Release	C	III	4	Set off MSA gas-detection alarm; solenoid valves would shut off stopping flow 8i operational slowdown				
9.5	Gashouse	CONTAMINATION	Debris in line	Valve/ Fitting Failure	D	I	2	Filter screens and Y-strainer in bulkhead				
9.5.2	Gashouse	CONTAMINATION	Wrong gas being used	Operational	N/A			Labeled bulkheads; manual valve on tank; SOPs				
9.6	Gashouse	RELIEF VALVE FAILURE	Debris in line	Valve/ Fitting Failure	D	I	2	Filter screens and Y-strainer in bulkhead				
9.6.1	Gashouse	RELIEF VALVE FAILURE	Valve stuck open	Release	C	II	3	Daily Inspections				
9.6.2	Gashouse	RELIEF VALVE FAILURE	Valve stuck shut	Release	C	II	3	Daily Inspections				
9.7	Gashouse	INSTRUMENTATION	Pressure gauge malfunction	Release	D	I	2	Daily readings; gas alarms; Daily Inspections; Monthly Complete System Inspections				
9.7.1	Gashouse	INSTRUMENTATION	LEL sensor malfunction	Fire/ explosion	C	II	3	Daily checklist; tanks checked three times, PSM in-place and being revised and updated				
9.8	Gashouse	CORROSION/ EROSION	Tank and/ or piping not maintained	Release	C	II	3	Part of monthly audit Cleaned and painted every other year, Daily Inspections; Monthly Complete System Inspections; SOPs				
9.9	Gashouse	IGNITION	Sparks from vehicle	Fire/ explosion	E	I	4	Chain link fence & road barricaded when unloading				
9.9.1	Gashouse	IGNITION	Sparks from static discharge	Fire/ explosion	D	I	2	Training; Grounding; SOPs				
9.9.2	Gashouse	IGNITION	Electrical sparks	Fire/ explosion	D	I	2	Training; Grounding; SOPs; and PSM				
9.10	Gashouse	SAFETY	Improper dothing	Injury	D	I	2	New tracking; initially plus every three years, Training, and PSM				
9.10.1	Gashouse	SAFETY	Improper electrical shutdown	Release, Fire, Injury	D	I	2	Chain link fence 8i road barricaded when unloading, ' Training; Grounding; SOPs; and PSM				
9.11	Gashouse	STARTUP	Improper adjustment on gashead (metering cylinder)	Release	C	III	4	Set off MSA gas-detection alarm; solenoid valves would shut off stopping flow				
9.11.1	Gashouse	STARTUP	Wrong gas used	Operational	N/A			Labeled bulkheads; manual valve on tank; SOPs				
9.12	Gashouse	SHUTDOWN	Valves not closed	Release	C	II	3	Daily Inspections				
9.12.1	Gashouse	SHUTDOWN	Power fluctuations or improper shutdown	Release, Rre, Injury	D	I	2	Chain link farce & road barricaded when unloading, Training; Grounding; SOPs; and PSM				

Item	Equip./Item	Guideword/ Deviation	Cause	Consequence	Risk Rank			Existing Controls	Recommendation	Risk Rank		
					F	C	R			F	C	R
9.12.2	Gashouse	SHUTDOWN	Hydraulic failure	Operational	N/A			Slowdown in production				
9.13	Gashouse	HUMAN FACTORS	Sparks from static discharge	Fire/ explosion	D	I	2	Training; Grounding; SOPs				
9.13.1	Gashouse	HUMAN FACTORS	Electrical sparks	Fire/ explosion	D	I	2	Training; Grounding; SOPs; and PSM				
9.13.2	Gashouse	HUMAN FACTORS	Improper tools	Fire/ explosion	D	I	2	Training; Grounding; SOPs; and PSM				
9.13.3	Gashouse	HUMAN FACTORS	Improper training	Injury	D	I	2	New tracking; initially plus every three years, Training, and PSM				
9.14	Gashouse	EXTERNAL EVENTS	Weather related	Fire/ explosion	D	I	2	ERP in-place, Annual Drills, Shear w/excess flow valves built-in				
9.15	Gashouse	SIGNAGE	Improper labeling of valves		E	I	4	Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence				
9.15.1	Gashouse	SIGNAGE	Smoking too close	Fire/ explosion	D	I	2	New tracking; initially plus every three years, Bulkhead, tanks and piping labeled, Warning signs and placards posted on tanks and fence				
9.16	Gashouse	VENTILATION	Insufficient ventilation	Could allow vapor buildup	C	III	4	LEL sensors; alarm sounds in ventilation units when flow changes				